	INTER PLANT STANDARD IN STEEL INDUSTRY	
◆ IPSS	**SPECIFICATION FOR SINGLE STAGE OVER DRIVEN WORM REDUCTION GEAR BOXES**	**IPSS: 1-01-002-18** (First Revision)
		Formerly: IPSS: 1-01-002-77

0.   FOREWORD

0.1   Interplant standardization in steel industry has been initiated under the aegis of the Indian Standards Institution (ISI) and the Steel Authority of India Limited (SAIL). The Interplant Standards prepared by the standard committee on Mechanical Drives, IPSS 1:1, with the active participation of the representatives of all the steel plants and leading consultants and was first adopted in December, 1977. Thereafter, standard revised with first revision in **November, 2018.**

0.2   Interplant standardization for steel industry primarily aims at achieving rationalization and unification of capacities and characteristics of remote control hydraulic jacks used in steel plant and provides guidance in indenting stores or equipment for existing or new installations by individual steel plants. For exercising effective control on the inventories, it is advisable to select a fewer number of sizes (or type) from among the products mentioned in this standards for the purpose of company standards of individual steel plants. It is not desirable to make deviations in technical requirements.

0.3   The centre to centre distance between the input and output shafts (dimension A in table 1) is a critical dimension since it involves the internal design features of the gear box. Even a slight change in this dimension would need corresponding changes in production facilities which may involve high expenditure on the part of the gear box manufacturers. They are not yet ready for making such investments due to several reasons including collaboration obligations, relatively low demand for worm deduction gear boxes by steel industry, etc. In view of this, it has not yet been possible to effect complete metrication in the values for centre distances included in this standard. A few metric sizes which are in the range of current Industrial Production or which the manufacturers have yet to develop have been satisfied.

0.3.1   The Principal external dimensions covered in this standard are agreeable to both the Steel Plants and the gear box manufacturers.

1.   SCOPE

This interplant standard covers the requirement of single stage over driven worm reduction gear boxes, such as centre distance, reduction ratio, input power, output torque, principal external dimensions, method of selection and supply conditions.
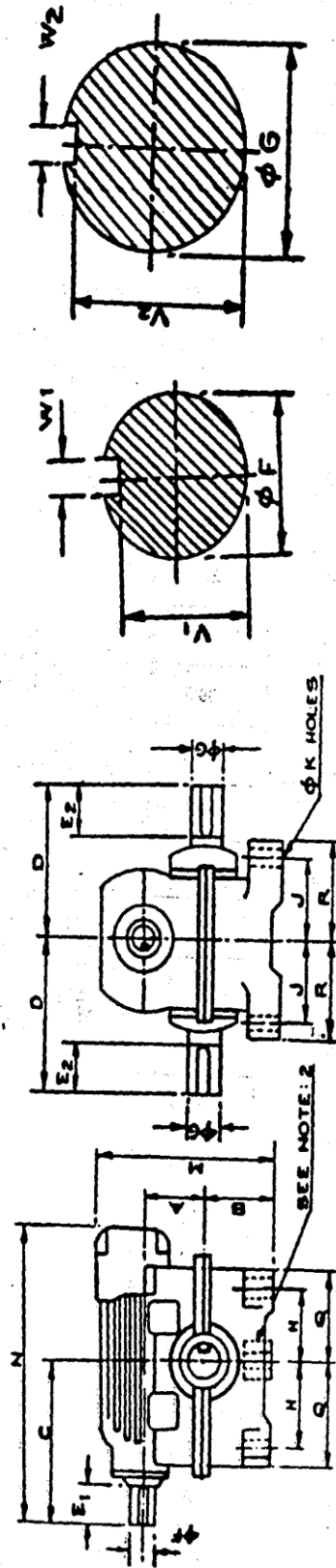
1.1 The internal design features of the gear boxes have not been covered in this standard.

1.2 This standard does not include gear boxes for EOT Cranes and mill drives.

2. **Dimensions**-: The dimensions of each unit shall be as given in Table-1. The keyway sizes shall be as given in Table-2.

3. **Rating**-: The unit size, centre distance between input and output shafts, reduction ratio, Input power and output torque of gear boxes shall be as given in Table-3.

4. **Construction**

4.1. Gear Box Casing – The gear box casing shall be made of closed grained cast iron conforming to Grade 260 or above specified in IS: 210-2009 'Specification of Grey Iron Castings (Fifth Revision)' or of fabricated construction, stress relieved, as agreed to between the suppliers and the users or Cast Steel Grade 280-520W as specified in IS : 1030-1998 ' Specifications for Carbon Steel Casting for General Engineering Purpose (Fifth Revision)'. It shall be free from harmful defects. Casing may also be fabricated out of steel conforming to IS:2062-2011 ' Specification for Structural Steel (Standard Quality)'

4.1.1. **Cast Iron gear box casing shall be artificially caged**

4.1.2. The casing shall have at least two lifting lugs suitably located for handling.

4.1.3. Breathers, Inspection covers, drain out plugs and dowel holes shall be provided at conveniently accessible locations. There shall be a provision for indicating the level of Oil. Dowel pins shall be supplied along with the gear box.

4.1.4. The joints of the casing shall be oil tight, dust proof and water proof.

4.1.5. The interior of the casing shall be painted with suitable anticorrosive paint.

4.1.6. Whenever shaft is extended on both sides of the casing, suitable safety cover for shaft shall be provided for fixing on any one side of the casing.

4.2. Bearings – The bearings shall be of antifriction type.

4.3. Oil Seals – There shall not be any seepage of oil at the sealing edges. Oil seals shall be of conforming to IS -5129. Also see IPSS 1-02-013-18 for reference of Rotary shaft oil seal units.

5. **Design**

5.1. Gears and Shafts – The manufacturer shall made suitable design for the gears and shaft to suit the load and working conditions.

5.2. Direction of Rotation – All the gear boxes shall be capable of working in any direction of rotation of the input shaft.

5.3. Hold Back Devices – There shall be provision for fixing up a hold back device.

6. **Lubrication** – All the gears and bearings shall have adequate lubrication. The temperature of the lubricating oil shall not exceed 20° (twenty degree) above ambient temperature. There shall be a provision to avoid mixing of grease with oil in case bearings are grease lubricated.

7.   **Selection of Gear Boxes** – The following methods are suggested:

a) Replacement of an existing gear box by a gear box as per this standard – An output torque value is to be selected from Table 3 which is at least equal to the output torque of the existing gear box – for the corresponding rev / min of the prime mover shaft.

b) Replacement of an existing gear box along with the prime mover or selection of a gear box for a new installation – Depending upon the location, intended prime mover and rigour of duty, the service factor of the gear box is to be selected from Table 1 of IS : 7403 – 1974 (R2001) Code of Practice for selection of Standard worm and helical gear boxes. The minimum output torque is to be calculated by multiplying the selected service factor with the actual torque requirement of the driven machine; the nearest higher value of the output torque from Table-3 would give the other parameters of the gear box needed.

8.   **Designation** – The under driven worm reduction gear boxes shall be designated by the following

a) Unit Size

b) Reduction ratio

c) Input Power

d) Input Speed and

e) Output Torque

Example: An over driven worm reduction gear box of unit size O-5M with reduction ratio 37:1, Input Power 5.15 kw, Input Speed 1000 rev / min and output torque of 16,600 kg cm shall be designated as-:

O-5M X 37:1 X 5.15 X 1000 X 16600

9.   **Marking** -: Every gear box shall have a name plate bearing the following particulars-:

a) Manufacturers Name, Trade Mark and year of manufacturer;

b) Designation of the gear box indicating its size; reduction ratio, input power, input speed and output torque; and

c) Manufacturers Serial Number

10.   **Technical Specification** – Every gear box shall be accompanied with the following information's

a) Specification and quality of lubricant

b) Bearing and oil seals used and

c) List and specifications of wearing parts

d) Inspection and Test certificate

11.   **Guarantee** – The gear box shall be guaranteed by the manufacturer for satisfactory service for a minimum period of 18 Months from the date of dispatch and 12 Months from the date of commissioning whichever is earlier. The manufacturer shall replace the unit/ components free of cost to the satisfaction of purchaser. If any material flaw, poor workmanship or

design defect is found during the guarantee period.

TABLE 1 DIMENSIONS OF SINGLE STAGE OVER DRIVEN WORM REDUCTION GEAR BOXES

(Clauses 0.3 and 2)

Unit Size	A Inches	A (mm)	B	C	D	E_1	E_2	For Input Shaft, ϕF ϕF	W_1	V_1	For Output Shaft, ϕG ϕG	W_2	V_2	H	J	Q Max	R Max	ϕK	M Max	N Max
0.3	3	(76.20)	90	170	165	38	57	24	8	20	38	10	33	75	70	90	90	22	240	320
0.3M		(80)	110	150	140	38	58	22	6	18.5	30	8	26	85	85	107.5	107.5	17	275	375
0.4	4	(101.60)	121	225	215	57	70	32	10	27	45	14	39.5	105	100	160	125	26	330	450
0.5	5	(127)	146	260	245	54	70	38	10	33	55	16	49	125	110	165	135	26	420	515
0.5M		(120)	150	218	187	56	78	30	8	26	45	14	39.5	100	75	137.5	100	22	370	368
0.6	6	(152.40)	171	275	270	64	80	38	10	33	60	18	53	135	120	200	160	30	450	550
0.7	7	(177.80)	197	315	295	80	110	45	14	39.5	65	18	58	150	135	185	160	30	545	625
0.7M		(180)	210	285	260	78	108	45	14	39.5	60	18	53	150	130	205	160	24	530	586
0.8	8	(203.20)	222	340	310	80	110	45	14	39.5	70	20	62.5	170	135	250	170	30	595	675
0.9	9	(228.60)	245	360	315	90	125	50	14	44.5	80	22	71.5	200	145	225	185	30	605	685
0.10	10	(254.00)	273	425	375	110	136	60	18	53	85	22	76.5	215	165	300	210	33	720	805
0.10.5	10.5	(266.70)	285	450	350	114	151	65	18	58	85	25	76.5	235	175	315	215	33	770	845
0.12	12	(304.80)	330	495	410	120	156	70	20	62.5	95	32	86	260	185	355	230	36	840	940
0.14	14	(355.60)	381	570	480	138	178	80	22	71.5	120	36	109	300	215	415	275	42	965	1 095
0.17	17	(431.80)	463	635	545	140	200	85	22	76.5	140	40	128	318	225	500	325	42	1 160	1 330
0.20	20	(508.00)	546	810	610	197	240	100	28	90	170	45	157	445	290	585	380	48	1 335	1 565
0.24	24	(609.60)	648	940	710	206	305	120	32	109	220	50	203	552	394	685	480	48	1 595	1 805

Note 1 — All dimensions are in millimetres unless otherwise stated.

Note 2 — Dimensions E_1 & E_2 are the portions of shaft available for coupling fitting purposes. At the discretion of the manufacturer, the shaft may be given a shoulder (with suitable radius) at this point.

Note 3 — Units with six mounting pads are permissible.

Table 2

TABLE 2 TOLERANCES ON DIMENSIONS OF SHAFTS AND KEYWAYS

(Clause 2)

SHAFT

Dia F or G mm	Tolerance Symbol	Tolerance Value microns
24	j6	+ 9
30		− 4
32	k6	+ 18
38		+ 2
45		
50		
55	m6	+ 30
60		+ 11
65		
70		
80		
85		+ 35
90		+ 13
95		
100		
120		
140		+ 40
170		+ 15
220		+ 46 / + 17

KEYWAY

Dimension W_1 or W_2 — Width mm	Tolerance symbol	Tolerance value microns	Dimension V_1 or V_2 — Value of V_1 or V_2 mm	Tolerance grade	Tolerance value microns
6	N9	0 / − 30	18·5	Grade 12	0 / − 0·1
8		0 / − 36	20		
10			26		
14		0 / − 43	27		
16			33		
18			39·5		
20		0 / − 52	42·5		
22			44·5		
25			49		
28			53		
32			58		
36		0 / − 62	62·5		
40			71·5		
50			76·5		
			81		
			86		0 / − 0·15
			90		
			109		
			128		
			157		
			203		

Table 3

TABLE 3 RATING OF SINGLE STAGE OVER DRIVEN WORM REDUCTION GEAR BOXES

(*Clauses 3 and 7*)

Unit Size	Centre Distance, A inches (mm)	Reduction Ratio	Capacity Input power/Output torque	Values corresponding to input speed 750 rev/min	1 000 rev/min	1 500 rev/min	Remarks
O-3	3 (76·20)	7·5 : 1	Input Power in kW*	2·68	3·28	4·38	R
			Output Torque in kg cm†	2 460	2 220	1 990	
		10 : 1	Input Power in kW*	2·22	2·93	3·73	R
			Output Torque in kg cm†	2 610	2 970	2 310	
		15 : 1	Input Power in kW*	1·68	2·10	2·52	R
			Output Torque in kg cm†	2 830	2 670	2 170	
		20 : 1	Input Power in kW*	1·43	1·75	2·24	R
			Output Torque in kg cm†	3 100	2 900	2 580	
		30 : 1	Input Power in kW*	1·07	1·33	1·64	R
			Output Torque in kg cm†	3 180	3 050	2 610	
		40 : 1	Input Power in kW*	0·91	1·07	1·34	IR
			Output Torque in kg cm†	3 480	3 180	3 020	
		60 : 1	Input Power in kW*	0·69	0·80	0·94	IR
			Output Torque in kg cm†	3 600	3 300	2 630	
O-3M	— (80)	10·25 : 1	Input Power in kW*	—	—	1·69	IR
			Output Torque in kg cm†	—	—	1 000	
		13·67 : 1	Input Power in kW*	—	—	1·36	IR
			Output Torque in kg cm†	—	—	1 040	
		20·5 : 1	Input Power in kW*	—	—	1·10	IR
			Output Torque in kg cm†	—	—	1 160	
		41 : 1	Input Power in kW*	—	—	0·73	IR
			Output Torque in kg cm†	—	—	1 320	
O-4	4 (101·60)	5 : 1	Input Power in kW*	8·09	9·56	12·35	R
			Output Torque in kg cm†	4 800	4 280	3 710	
		7·5 : 1	Input Power in kW*	5·66	6·71	12·52	R
			Output Torque in kg cm†	5 025	4 460	3 700	
		10 : 1	Input Power in kW*	4·85	5·96	7·46	R /
			Output Torque in kg cm†	5 400	4 910	4 230	
		15 : 1	Input Power in kW*	3·50	4·25	5·37	R
			Output Torque in kg cm†	5 600	5 070	4 400	
		20 : 1	Input Power in kW*	3·06	3·57	4·56	R
			Output Torque in kg cm†	6 150	5 600	4 950	
		30 : 1	Input Power in kW*	2·24	2·68	3·35	R
			Output Torque in kg cm†	6 380	5 800	5 100	
		40 : 1	Input Power in kW*	1·94	2·24	2·84	IR
			Output Torque in kg cm†	6 890	6 300	5 500	
		60 : 1	Input Power in kW*	1·26	1·49	1·87	IR
			Output Torque in kg cm†	5 975	5 475	4 850	
O-5	5 (127)	7·5 : 1	Input Power in kW*	10·81	12·67	16·03	R
			Output Torque in kg cm†	9 575	8 450	7 200	
		10 : 1	Input Power in kW*	9·04	11·03	14·25	R
			Output Torque in kg cm†	10 400	9 560	8 330	
		15 : 1	Input Power in kW*	5·89	7·09	9·11	R
			Output Torque in kg cm†	9 600	8 800	7 600	

*Rated   R = Reversible
†Minimum   IR = Irreversible

Table 3 Continued

TABLE 3 RATING OF SINGLE STAGE OVER DRIVEN WORM REDUCTION GEAR BOXES — *Contd*

Unit Size	Centre Distance, A		Reduction Ratio	Capacity				Remarks
				Input power/Output torque	Values corresponding to input speed			
	Inches	(mm)			750 rev/min	1 000 rev/min	1 500 rev/min	
O-5 Contd	5	(127)	20 : 1	Input Power in kW* Output Torque in kg cm†	5·29 11 070	6·49 10 350	8·35 9 150	R
			30 : 1	Input Power in kW* Output Torque in kg cm†	3·87 11 600	4·62 10 520	5·96 9 275	R
			40 : 1	Input Power in kW* Output Torque in kg cm†	2·91 10 620	3·65 10 350	4·70 8 750	IR
			60 : 1	Input Power in kW* Output Torque in kg cm†	2·09 10 680	2·54 9 830	3·28 8 700	IR
O-5M	—	(120)	10·33 : 1	Input Power in kW* Output Torque in kg cm†	— —	— —	3·68 2 200	IR
			15·5 : 1	Input Power in kW* Output Torque in kg cm†	— —	— —	2·94 2 400	IR
			31 : 1	Input Power in kW* Output Torque in kg cm†	— —	— —	1·84 2 800	IR
O-6	6	(152·40)	10 : 1	Input Power in kW* Output Torque in kg cm†	12·98 15 300	15·50 13 600	20·15 11 500	R
			12·5 : 1	Input Power in kW* Output Torque in kg cm†	10·96 16 600	13·31 15 300	17·28 13 100	R
			15 : 1	Input Power in kW* Output Torque in kg cm†	9·93 16 850	12·08 15 350	16·29 13 800	R
			25 : 1	Input Power in kW* Output Torque in kg cm†	6·26 16 000	7·78 15 200	10·07 13 300	R
			30 : 1	Input Power in kW* Output Torque in kg cm†	5·59 17 600	6·84 16 400	9·04 14 600	R
			35 : 1	Input Power in kW* Output Torque in kg cm†	4·92 17 360	6·10 16 350	8·13 14 670	IR
			40 : 1	Input Power in kW* Output Torque in kg cm†	4·70 17 950	5·81 17 140	7·61 15 350	IR
O-7	7	(177·80)	5 : 1	Input Power in kW* Output Torque in kg cm†	25·36 15 150	32·37 14 950	44·19 13 650	R
			7·5 : 1	Input Power in kW* Output Torque in kg cm†	20·52 18 600	26·07 17 800	35·78 16 350	R
			10 : 1	Input Power in kW* Output Torque in kg cm†	17·76 20 700	21·47 18 750	27·43 16 150	R
			12·5 : 1	Input Power in kW* Output Torque in kg cm†	14·77 22 000	18·52 20 700	26·03 19 550	R
			25 : 1	Input Power in kW* Output Torque in kg cm†	9·41 25 500	11·62 23 600	15·74 21 600	R
			30 : 1	Input Power in kW* Output Torque in kg cm†	7·68 23 700	9·40 22 400	12·82 20 600	R
			40 : 1	Input Power in kW* Output Torque in kg cm†	6·72 26 350	8·37 24 800	11·26 22 900	IR
			50 : 1	Input Power in kW* Output Torque in kg cm†	5·67 29 400	7·60 27 400	9·18 23 000	IR
			60 : 1	Input Power in kW* Output Torque in kg cm†	5·29 27 800	6·19 25 300	7·71 21 750	IR

*Rated   R — Reversible
†Minimum   IR — Irreversible

Table 3 Continued

TABLE 3 RATING OF SINGLE STAGE OVER DRIVEN WORM REDUCTION GEAR BOXES — Contd

Unit Size	Centre Distance, A inches (mm)	Reduction Ratio	Capacity Input power/Output torque	Values corresponding to input speed 750 rev/min	1 000 rev/min	1 500 rev/min	Remarks
O-7M	— (180)	12·33:1	Input Power in kW*	—	11·03	—	IR
			Output Torque in kg cm†	—	13 500	—	
		18·5:1	Input Power in kW*	—	8·09	—	IR
			Output Torque in kg cm†	—	14 530	—	
		37:1	Input Power in kW*	—	5·15	—	IR
			Output Torque in kg cm†	—	16 610	—	
		51:1	Input Power in kW*	—	3·68	—	IR
			Output Torque in kg cm†	—	15 270	—	
O-8	8 (203·20)	20:1	Input Power in kW*	14·33	17·46	22·69	R
			Output Torque in kg cm†	43 100	29 400	25 600	
		25:1	Input Power in kW*	12·88	15·74	20·96	R
			Output Torque in kg cm†	35 400	32 200	29 200	
		40:1	Input Power in kW*	8·58	10·81	14·18	IR
			Output Torque in kg cm†	35 000	33 600	29 600	
O-9	9 (228·60)	20:1	Input Power in kW*	17·92	21·99	27·74	R
			Output Torque in kg cm†	41 500	38 500	32 200	
		40:1	Input Power in kW*	10·15	13·42	17·92	R
			Output Torque in kg cm†	43 600	43 000	33 000	
O-10	10 (254)	7·5:1	Input Power in kW*	35·01	44·75	64·24	R
			Output Torque in kg cm†	31 400	30 500	29 000	
		10:1	Input Power in kW*	31·25	40·63	57·07	R
			Output Torque in kg cm†	38 400	37 400	35 100	
		12·5:1	Input Power in kW*	28·28	36·18	49·24	R
			Output Torque in kg cm†	42 750	41 400	37 700	
		20:1	Input Power in kW*	20·14	27·02	35·04	R
			Output Torque in kg cm†	47 400	46 600	41 400	
		25:1	Input Power in kW*	18·20	23·09	30·96	R
			Output Torque in kg cm†	52 200	50 000	44 900	
		40:1	Input Power in kW*	12·37	15·88	21·29	IR
			Output Torque in kg cm†	51 400	49 500	45 250	
		45:1	Input Power in kW*	10·81	13·75	18·01	IR
			Output Torque in kg cm†	50 600	48 300	43 125	
O-10·5	10·5 (266·67)	20:1	Input Power in kW*	26·47	33·83	43·39	R
			Output Torque in kg cm†	62 212	61 636	52 995	
O-12	12 (304·80)	12·5:1	Input Power in kW*	40·81	52·21	71·63	R
			Output Torque in kg cm†	59 800	57 500	53 000	
		15:1	Input Power in kW*	36·62	47·36	63·32	R
			Output Torque in kg cm†	64 000	61 600	55 250	
		20:1	Input Power in kW*	29·40	37·95	50·30	R
			Output Torque in kg cm†	67 500	66 250	58 400	
		50:1	Input Power in kW*	14·18	18·24	24·56	IR
			Output Torque in kg cm†	72 300	70 250	63 300	
		60:1	Input Power in kW*	12·22	15·94	21·62	IR
			Output Torque in kg cm†	72 700	71 400	65 800	

*Rated R = Reversible
†Minimum IR = Irreversible

Table 3 Continued

TABLE 3 RATING OF SINGLE STAGE OVER DRIVEN WORM REDUCTION GEAR BOXES — Contd

Unit Size	Centre Distance, A Inches (mm)	Reduction Ratio	Input power/Output torque	750 rev/min	1 000 rev/min	1 500 rev/min	Remarks
O-12 Contd	12 (304·80)	70 : 1	Input Power in kW* Output Torque in kg cm†	10·00 67 700	12·83 65 500	17·50 61 400	IR
O-14	14 (355·60)	10 : 1	Input Power in kW* Output Torque in kg cm†	61·33 74 175	76·48 69 000	102·22 62 100	R
		40 : 1	Input Power in kW* Output Torque in kg cm†	23·68 102 400	30·59 99 000	41·73 91 000	R
		50 : 1	Input Power in kW* Output Torque in kg cm†	17·91 93 500	23·83 93 250	34·27 90 400	IR
O-17	17 (431·80)	10 : 1	Input Power in kW* Output Torque in kg cm†	80·89 98 900	100·01 90 850	131·64 80 500	IR
		15 : 1	Input Power in kW* Output Torque in kg cm†	69·86 123 500	87·36 115 000	113·99 101 100	R
		20 : 1	Input Power in kW* Output Torque in kg cm†	59·64 138 700	76·11 131 300	102·96 120 000	R
		30 : 1	Input Power in kW* Output Torque in kg cm†	46·04 155 000	58·10 146 000	74·56 126 800	R
		40 : 1	Input Power in kW* Output Torque in kg cm†	36·03 163 500	46·22 150 000	61·11 133 500	R
		45 : 1	Input Power in kW* Output Torque in kg cm†	31·62 155 400	40·74 150 000	54·42 135 000	IR
		60 : 1	Input Power in kW* Output Torque in kg cm†	25·74 159 000	33·17 154 300	44·42 138 000	IR
		70 : 1	Input Power in kW* Output Torque in kg cm†	22·28 157 800	28·35 152 000	38·68 146 000	IR
O-20	20 (508)	15 : 1	Input Power in kW* Output Torque in kg cm†	97·81 174 000	120·75 161 000	155·02 138 000	R
		50 : 1	Input Power in kW* Output Torque in kg cm†	42·06 218 500	52·21 210 000	66·41 182 000	IR
O-24	24 (609·60)	20 : 1	Input Power in kW* Output Torque in kg cm†	120·09 282 000	145·46 255 000	158·95 188 000	R

*Rated   R = Reversible
†Minimum   IR = Irreversible

Note — *Reversibility* — A gear box is considered to be reversible if the rotation of output shaft is possible without any damage to gear box when input power is switched off.

Irreversibility — A worm gear is irreversible if the reversed efficiency is zero or negative i.e. if the lead angle of worm is equal to or less than the angle of the friction.

Caution — Irreversible gear boxes shall not be used where the reversibility is required.